An Introduction to VarAC

Amateur data modes have evolved over an extended period, with modes such as RTTY, AMTOR, PSK-31 and FT8 taking turns in the spotlight to dominate. The current favourite, FT8, is quite a remarkable mode for communicating under challenging conditions and has been ideal for use during poor propagation and the increasing QRM from technology in the home. One of the many reasons behind the mode's success has been the use of a fixed message format. Whilst this provides a clear benefit for securing marginal contacts, there is no room for dialogue between operators. This leaves operators missing out on sharing ideas and making new friends. Whilst many modes are available that support keyboard-to-keyboard chatting, utilisation is extremely low, making it difficult to find partners for a QSO. To help solve this problem, one group has set about developing a new chat mode that utilises the technology available to many of today's operators. Developed by Irad Deutsch, 4Z1AC and a team of enthusiasts, that Mode is VarAC. Since its launch in October 2021, the Mode has enjoyed continuous development and the latest release, version 7, is a well-honed data mode rapidly gaining in popularity. In this article, I'll explain more about VarAC and provide guidance to start operating.

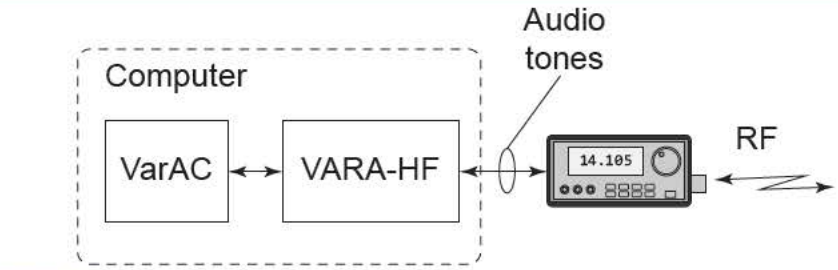

FIGURE 1: VarAC communication link showing VarAC and the VARA-HF modems.

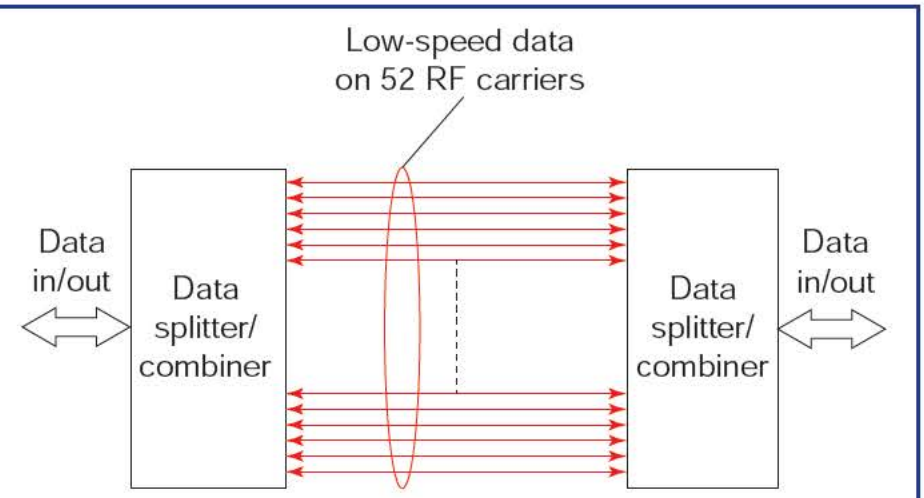

FIGURE 2: Illustration of OFDM.

Inside VarAC

VarAC is a client application that uses the VARA modem to manage the communications link, (Figure 1). The name is derived by combining the founder's callsign 4X1AC with the Vara modem. Let's begin with a look at the Vara modem. Developed by Jose Ros, EA5HVK, the VARA modems are derived from his popular RosModem. There are three variants available: VARA-HF, VARA-FM and VARA-SAT. As you can probably guess, VARA-HF is for the HF bands, VARA-FM is for the VHF/UHF bands and VARA-SAT is for QSOs through the QO-100 geostationary satellite. Most VarAC operation currently occurs on the HF bands, so I'll focus on that here.

VARA-HF

The VARA-HF modem is an adaptive device that can automatically change its modulation and speed to achieve the best throughput given the prevailing propagation conditions. The modem has similarities to a packet modem as it can accept commands, set up links, and pass messages. When instructed to send a message to another station, the VARA-HF modem will call that station and create a fully error-corrected link. With the connection established, the modem splits the message into packets and checks each packet for successful receipt. Damaged packets are repeated until the message is successfully received. Like the earlier AMTOR system, VARA-HF creates a locked, 1:1 link between two stations. Third parties can monitor the link but will not be part of the error-correcting loop, so they may miss parts of the message or see unnecessary repeats. The VARA-HF modem has become very popular recently and is currently the preferred modem for use with the popular WinLink HF email system. Accessing the full VARA-HF speed range requires a paid licence (€63), but the free tier supports rates up to 200 baud, which is plenty for most VarAC keyboard QSOs. VARA-HF employs OFDM (Orthogonal Frequency Division Multiplex) to achieve its reliable radio link. This uses 52 closely spaced carriers, each carrying a portion of the data. The modulation system applied to each carrier

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FIGURE 3: VarAC My Info panel.

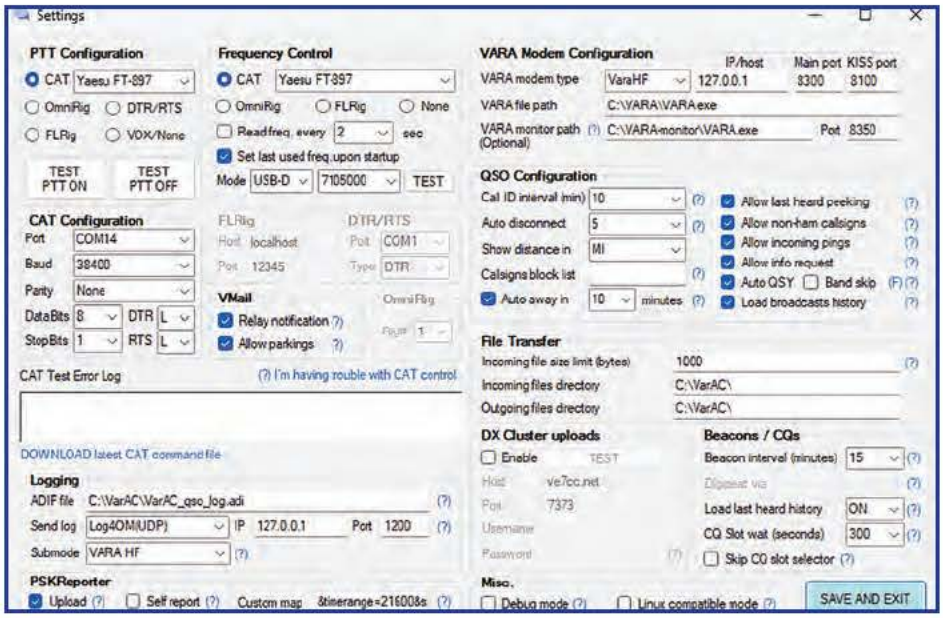

FIGURE 4: VarAC – Settings panel.

depends on the selected data rate, for all rates up to 799bps BPSK (Binary Phase Shift Keying) is used. At higher speeds, the modulation first changes to 4PSK (Phase Shift Keying), 8PSK, then 16QAM (Quadrature Amplitude Modulation) and finally 32QAM to achieve an impressive user data rate of 5,629bps. I've illustrated OFDM in (Figure 2).

VarAC client

VarAC is a client application that uses the VARA-HF modem to provide the communication link. VarAC's role is to add all the bells and whistles that transform a simple message link into a feature-rich data mode. The result is one of the best HF chat systems ever produced. Let's just run through some of the highlight features of VarAC:

- **Easy QSOs:** Calling CQ is a well-managed process that includes automatic QSY from calling to working channels.
- **Automatic logging:** VarAC supports most popular logging programs and stores contacts in a standard ADIF file that's easily imported into other logging systems.
- **CAT control:** this is fully integrated and includes many popular rigs.
- **Beacons:** you can activate a beacon to show general availability.
- **Automated QSY:** includes an automated process to QSY to a different channel or band.
- **Ping:** before calling, you can ping other stations to check the link quality.
- **Spellcheck:** this operates live.

Installing VarAC

There are two parts to a VarAC installation. The first step is to install the VARA-HF modem, followed by the VarAC application. You'll be pleased to know that both software packages are available as free downloads. I've provided this step-by-step guide to help you through the installation.

1. Download VARA-HF from the EA5HVK weak signal site at:
   https://rosmodem.wordpress.com

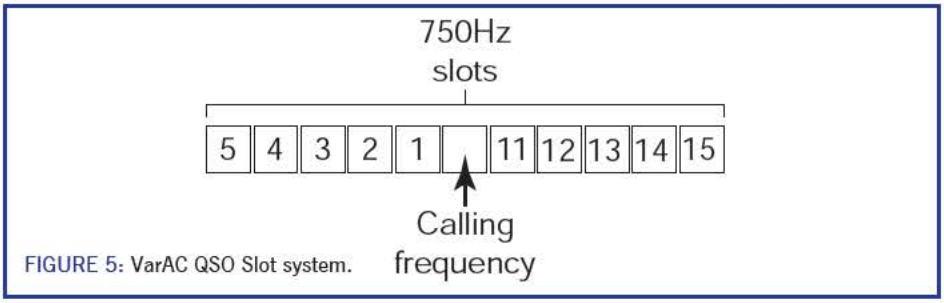

FIGURE 5: VarAC QSO Slot system.

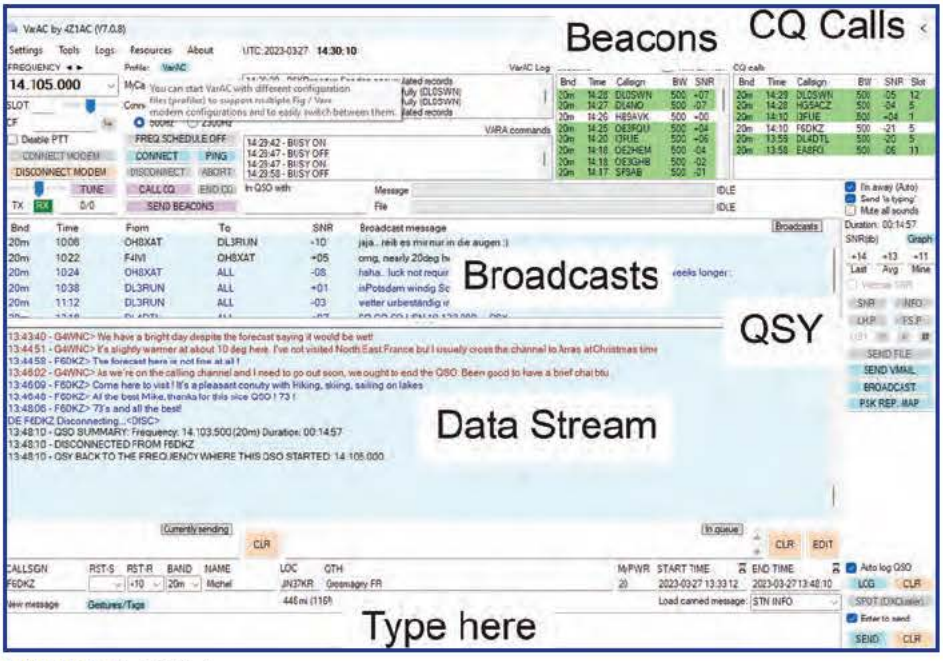

FIGURE 6: VarAC Main screen.

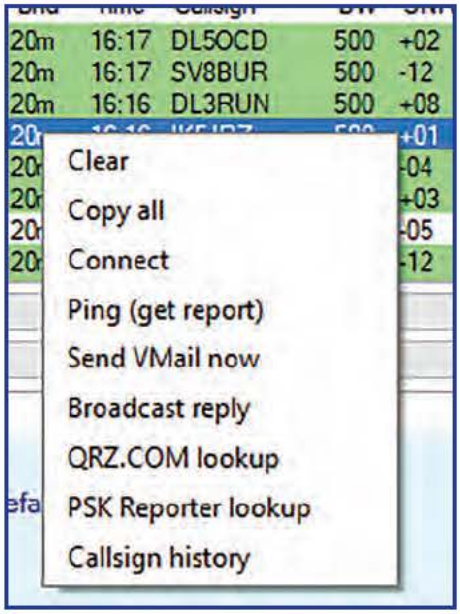

FIGURE 7: VarAC beacon options.

Monitoring G4WNC (last heard 6 mins ago). Automatic refresh in 5 minutes. Small markers are the 43 transmitters heard at G4WNC (113 reports, 10 countries last 24 hours; 302 reports, 18 countries last week).
Monitor: N2MQK Loc EN90TS
In Pennsylvania, United States
Receiving: VARAC on 7.105 MHz (40m)
Using: VarAC V7.0.8/Rptr V1.9
Antenna: MFJ 1699s
Show all seen by N2MQK
© OpenMapTiles © OpenStreetMap contributors

FIGURE 8: PSK Reporter map.

2. Double-click on the downloaded file and choose Extract All to expand the zip file.
3. Right-click on the extracted VARA setup file, choose Properties and click Unblock at the bottom of the General tab. Click OK to close.
4. Double-click the expanded VARA setup file to begin installation and accept the defaults.
5. On completion, VARA-HF will be installed in the C:\VARA folder.
6. We must also create a second copy of VARA-HF for monitoring in-progress calls.
7. Create a new folder named: C:\VARA-monitor
8. Press the Windows key and E twice to open up two Windows Explorer panels.
9. Use the two panels to copy and paste the entire contents of C:\VARA to C:\VARA-monitor. Note: make sure you press and hold the Ctrl key, so you copy the files instead of moving them.

That completes the installation of two copies of the VARA-HF modem, but we need to configure the modem to use your soundcard. Here are the steps:

1. Navigate to C:\VARA and double-click on VARA.exe to run the VARA modem.
2. Click on the Settings menu and select Soundcard…
3. Set the Device input and output to point to your soundcard or rig.

You only need to configure one of the modems because VarAC will configure the second modem.

Now we can install the VarAC application as follows:

1. Download the latest VarAC from: https://www.varac-hamradio.com
2. Double-click the downloaded zip file, select Extract All, and set the destination to C:\VarAC
3. Locate the VarAC.exe file and right-click to open Properties.
4. In the general tab make sure Unblock is ticked in the General tab and hit OK.

Configuring VarAC

With the installation complete, we can move on to the configuration. To enjoy the full benefits of VarAC you need to have CAT control working with your rig. The first step is to open the Settings menus and choose My information (**Figure 3**). You should enter your personal and station details here. This section is essential because it is used in automated transmissions. When you've completed this section, please remember to hit SAVE AND EXIT to save the information. Next, you need to move on to the Settings menu and Rig control and VARA configuration (**Figure 4**). This busy menu is where you set up CAT control, logging and monitoring. Configuration is straightforward, and here are the main steps you should follow:

1. In PTT Configuration and Frequency Control, select CAT and choose your rig from the drop-down menu.
2. Further down the panel, enter the CAT baud rate, data bits, etc as per your rig's user manual.
3. Next, you can check that the CAT is working. Press the TEST PTT ON button to put the rig into transmit and use the TEST PTT OFF button to switch to receive.
4. Now move to the Frequency Control section and try using different settings for the Mode and frequency, followed by pressing TEST. This should switch the rig to the selected modes.
5. If both tests worked, you have successfully configured CAT control.
6. Next, we'll complete the VARA modem configuration.
7. The Modem type should be VaraHF, with VARA file path set to: C:\VARA\VARA.exe
8. The VARA monitor path should be: C:\VARA-monitor\VARA.exe

That completes the basic configuration, however, if you want to link VarAC to your logging software, the VarAC help file contains example setups for most of the popular logging software.

Operating VarAC

As with all new modes, I recommend monitoring the VarAC frequencies to familiarise yourself with how the mode is used. The two most active bands are 20m and 40m, where the calling frequencies are 14.105MHz and 7.105MHz, respectively. Unlike FT8 and the earlier PSK-31, VarAC traffic cannot be contained within a single SSB channel, so the developers have devised a custom band. This comprises a central calling frequency and ten 750Hz spaced working channels known as slots, located above and below the calling frequency. I've illustrated the system in **Figure 5**. VarAC users advertise their availability by sending periodic beacon transmissions. These are generally sent on the calling frequency every 15 minutes and activated by pressing the SEND BEACONS button. All received beacons are displayed in the Beacons panel (**Figure 6**), along with the callsign, time and SNR report. These beacon reports provide a helpful guide to active stations, plus you can interact with those stations. If you right-click on a beacon callsign, you will see a list of options (**Figure 7**). One of the most useful is to Ping the station. This creates a temporary connection between the two stations and retrieves a signal report for both directions. This is a helpful way to check

TABLE 1: Canned messages

Canned Message Name	Content
My Info	<NAME> <QTH> <LOC> <SND>
Station Info	<RIG> <PWR> <ANT> <SND>
Sign-off	73 and thanks for the QSO DE <CALL> Disconnection <SND><DISC>

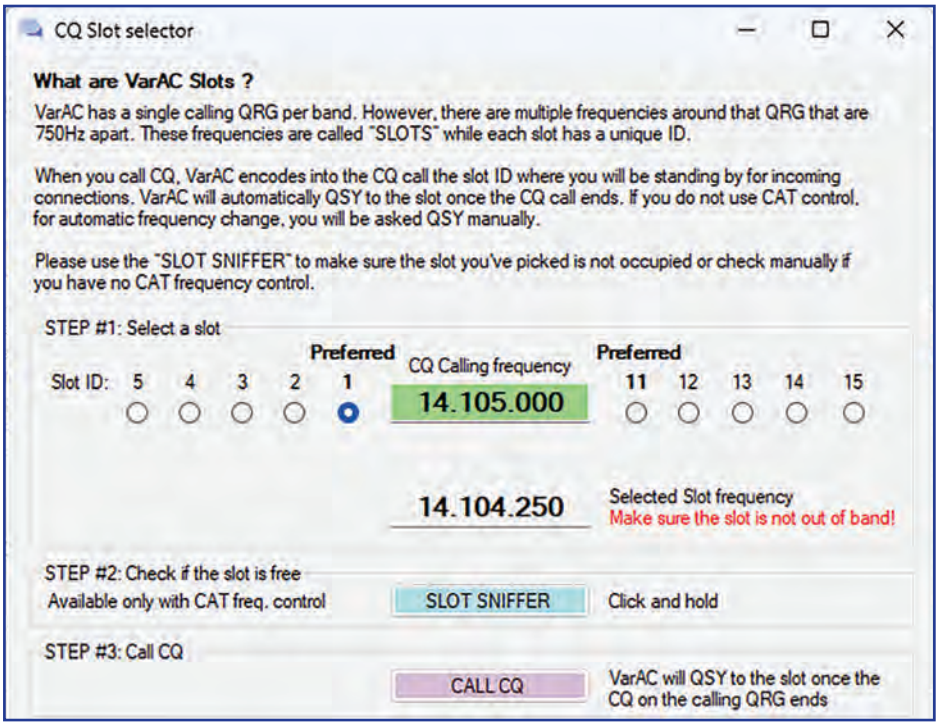
CQ Slot selector
What are VarAC Slots ?
VarAC has a single calling QRG per band. However, there are multiple frequencies around that QRG that are 750Hz apart. These frequencies are called "SLOTS" while each slot has a unique ID.
When you call CQ, VarAC encodes into the CQ call the slot ID where you will be standing by for incoming connections. VarAC will automatically QSY to the slot once the CQ call ends. If you do not use CAT control, for automatic frequency change, you will be asked QSY manually.
Please use the "SLOT SNIFFER" to make sure the slot you've picked is not occupied or check manually if you have no CAT frequency control.
STEP #1: Select a slot
Preferred
Preferred
Slot ID: 5 4 3 2 1
CQ Calling frequency
14.105.000
11 12 13 14 15
14.104.250
Selected Slot frequency
Make sure the slot is not out of band!
STEP #2: Check if the slot is free
Available only with CAT freq. control
SLOT SNIFFER
Click and hold
STEP #3: Call CQ
CALL CQ
VarAC will QSY to the slot once the CQ on the calling QRG ends

FIGURE 9: VarAC CQ Panel

that your system is working and indicates whether a QSO is possible. If you want to try calling the station, right-click again and choose Connect. This will initiate a connection and a QSO, provided the station operator is available for a chat. However, before you start your first QSO it's worth configuring your canned messages.

Canned messages

In VarAC, canned messages are similar to the macros used in PSK-31, ie they store commonly sent message fragments to save typing. VarAC software has the capacity for eight canned messages, each assigned to a Function key (F1 to F8) for easy access. You can also retrieve them by name using the drop-down menu at the bottom-right of VarAC. Because VarAC is so good for free chatting, I suggest you keep canned messages to a minimum. However, a few essential exchanges are best handled with canned messages. These are your name, QTH, locator, rig, power, and antenna details. Whilst you can include these in your free chat, it is difficult for logging programs to extract and transfer this data to the log accurately. The solution used by VarAC is to use special message tags. For example, the operator name is sent as <NAME> and QTH as <QTH>. VarAC recognises the tag and automatically adds the required information. When I use the tag <NAME>, VarAC automatically adds the required data and transmits <NAME:Mike>. Wrapping the information in this format makes it easy for the receive station to identify and transfer the data to the matching fields in the log.

In VarAC, we can take the automation further and store the tags in canned messages. I have created two canned messages, one called My Info and the other called Station Info, as shown in **Table 1**. At the start of a QSO I send the My Info message, so the operator has my name and location. On the second over, I usually send the Station Info message to provide more detail for the log. The other useful message is a sign-off, as shown in Table 1. You may notice I've included some extra tags at each message's end. <SND> triggers VarAC to send the message immediately instead of waiting for more text, whilst <DISC> will disconnect the current connection.

QSO Technique

With your station set up it's time to start with a few QSOs. The best way to start is to tune to the 20m calling frequency (14.105MHz) and turn on SEND BEACONS. This will announce your availability. Shortly after the first beacon goes out try pressing the PSK REP MAP button to see who's receiving your signal (**Figure 8**). Visibility in PSK Reporter will confirm that your station is working ok. If the band is busy, you should soon see a CQ call in the CQ calls panel. To respond to that station, simply double-click on their callsign. This will start a connection and automatically QSY your rig to the working frequency. You should see a connected message in the Data stream panel if all is well. The next step is to send the My Info canned message, so the operator has your name, call and QTH. I usually follow that up with 'btu' to clarify that I'm waiting for a response. The other operator will generally respond by thanking you for the call and sending their information. I've noticed the changeover between overs is sometimes uncertain at the beginning because you don't have to add the conventional their call/your call response. VarAC offers help by displaying an 'is typing' message when the other station is typing their response. At the end of the QSO the rig will automatically QSY back to the calling channel.

Calling CQ

Once you've responded to a few QSOs, you can try initiating a call. VarAC includes an excellent menu-driven CQ panel (**Figure 9**). The first step is to select a Slot to use as the working frequency. Next, click and hold on the Slot Sniffer. This will temporarily return your rig to the selected slot so you can check that it's free. If all is well, you can move on to the final stage and click the CALL CQ button. This will initiate a CQ call on the calling frequency and QSY your rig to the working slot to await a response. If there's no response after five minutes, VarAC will abandon the call and QSY back to the calling channel. This is an excellent way to manage CQ calls that works exceptionally well.

Occasionally, you may engage in a QSO on the calling frequency. This often occurs when another station calls in response to your beacon transmission. To facilitate a smooth QSY to a working frequency, VarAC now includes a managed QSY process. You will find the QSY buttons in the lower right-hand section of VarAC. Note: these buttons are only active when you are connected to another station. To QSY you can click the up and down arrows to move in 750Hz steps. However, my preferred method is to click on the # button where you will see a panel very similar to the CQ panel. Here you can select and test the desired QSY slot and initiate the QSY. Once selected, VarAC manages the frequency change without breaking the connection. After you initiate the QSY request, the other operator will see a notification on their screen. They can cancel the QSY but, if they take no action, the QSY will proceed automatically.

Summary

I hope this article has whetted your appetite to try this new data mode. VarAC is enjoying plenty of attention and it's becoming increasingly easy to make QSOs. It's also refreshing to link with data operators that are happy to chat. VarAC has many more features, including email and broadcast facilities so please read the manual and visit the website for the latest information. They also have a very active Facebook group (VARA operators) which is worth a look.

My RSGB Tonight@8 presentation *Back to the Keyboard!,* in which I discuss keyboard data modes including VarAC, can be found on the RSGB's YouTube channel: youtube.com/thersgb

If you are interested in software and systems and would like your work to appear in this column, please email radcom@rsgb.org.uk

HF

Well, conditions have continued to be good, with some consequent highs and a few lows but, largely speaking, most of the people I speak to are enjoying favourable conditions and working some good DX.

PHOTO 1: TDARC Field Day.

The unusally warm and dry February meant that my main focus was on outdoor jobs around the smallholding and radio was contained to the odd evening. Although I didn't work a great deal of DX, I did enjoy a good number of CW ragchews around Europe, which is what makes me happiest in any event. I mentioned in the last column that I would be chasing the Bouvet Island DXpedition, and I did indeed listen on a number of occasions, but I was unable to hear them, despite using my Yagi, due to severe QRM. Having said that, a friend nearby did manage to work them on four bands. I was very impressed by that, even though he is an avid DXer. It is clear that the DXpedition was much tougher than the crew had anticipated and I take my hat off to them for even trying it!

My local club, Taunton and District Amateur Radio Club, has recently begun to re-energise itself and to seek to attract new members. On Saturday 11 March the club met at a farm shop near to Chard, Somerset and enjoyed a good take off in the Blackdown Hills. The owner kindly agreed to let us use her field and 19 members arrived with a variety of equipment for both HF and VHF operating. Antennas were erected and soon a number of contacts were in the log, aided by the use of the club call, G5JJ, and the inevitable SSB competition that was running. The weather was a little chilly so most operating was done from the cars. As a first trial of the year, it was a great success and more are being panned as I write [1]. A photo of the club members is shown (photo 1) and I was pleased to work the US and Canada with 5W SSB, as well as a few CW and FT4 contacts too.

As I write this, I am coming to the conclusion of a week long holiday in La Gomera, in the Canary Islands. I am here with two friends for walking but, of course, I just had to bring my radio gear with me for some ancillary EA8/G4USI fun. Packing my new Icom IC-705 and a variety of accessories, I felt well equipped for the odd hour or so of operation here and there. The house we were staying in was beautiful with spectacular views of the sea, but surrounded on three sides by 1300ft mountains, meaning that the only real take-off was across to the island of Tenerife and on to the North and North East. As a result, all of my QSOs, with my 5W and end-fed half-wave antenna, were to Europe. The operations were not without some difficulty. I took two homebrew CW keys, both of which decided to play up, and I had to resort to keying with a combination of the memory keyer in the rig and using one of the buttons on the microphone in straight key mode. During this period, I made contact with Matthew Barker, MOMZB, from Cumbria. Matthew was very patient with my "sticky" keying and we had a pleasant QSO. A keen SOTA operator, Matthew's QSL card is pictured (photo 2), as well as a photo of my operating position (photo 3).

PHOTO 2: M0MZB's QSLcard.

In other news from the G4USI shack, just before my holiday I brought a non-working Heathkit HW8 which was advertised as "dead." Having fully restored a HW9 last year, I was keen to add an HW8 too. So, I took the risk. To my surprise the unit did power up, but output power as measured on my oscilloscope was just a couple of hundred milliwatts on each band. I traced this to ZD2 – a Zener Diode designed to protect the final transistor from high SWR and which had gone 'leaky'. Replacement brought me the fairly typical 1 or 2 watts output, depending on band, that is expected from this rig, and a full re-alignment immediately followed, improving receive quite dramatically. For just a couple of hours work, I now have an immaculate, vintage HW8 in my 'QRP Corner' (photo 4) and F6FAI in the log on 40m!

Reports

My co-author of this column this column, John Petters, G3YPZ has spent a lot of time on 10m this last month using a four-element mono-bander at 28ft and reports the following QSOs: 29MHz FM: VK6IA, VK6RO, VK8SSB,CN8ZG (worked on the IC-7300 with 80W); 29MHz AM: WP2ASS (US Virgin Islands) PU2YBW, Ws and VEs most days (KW Vanguard, 30W); 28MHz CW: ZL4AX worked, who was running 4W to a vertical (Elecraft K3, 100W).

Peter, G4XEX, reports what he describes as a "stunning month" of activity and has noticed that the 10 and 12m bands are now open most days from before sunrise until well after sunset. Joining in the fun on the St Patricks Day Award, Peter worked more JA stations in one day than during the rest of the month, most of them on 10m. Indeed, the bulk of his DX working came from the Far East last month, with his favourite DX

Daimon Tilley, G4USI
Reports to radcom@rsgb.org.uk
by 25 April 2023